

constituents of flour, include descriptions of baking-tests, absorption and dough-tests, and the two best-known means of recognising bleached flour, namely, extraction of the colouring matters with light petroleum, and the detection of nitrites in the sample.

An extension which will be found very useful is a separate chapter upon the examination of flavouring-extracts and their substitutes. Processes are given for the determination of vanillin, coumarin, benzaldehyde, lemon oil, wintergreen oil, and other essential oils occurring in extracts and essences; and notes upon adulterants and imitations are also included.

It will be readily understood that with so large a field to cover a single volume does not, even with a thousand pages, suffice for any exhaustive discussion of the various topics. The really difficult cases of adulteration, the doubtful "border-line" problems, remain always dependent for their solution upon the experience, skill, and wider knowledge possessed by the analyst. Beyond this general observation, however, there is little but praise to bestow upon the book. Apart from one or two misprints, the only questionable matter noticed is the Defren's table on pp. 595-7, where the values of lactose appear rather doubtful; and one may claim a little grumble at the pounds avoirdupois; the book is not, in the literal sense, likely to be a *vade mecum*. It will lie on the laboratory table, but it will be worth its place there. C. S.

THE MOVEMENTS OF CHROMATOPHORES IN PLANTS.

Die Gestalts- und Lageveränderung der Pflanzen-Chromatophoren. By Dr. Gustav Senn. Pp. xv + 397. (Leipzig: W. Engelmann, 1908.) Price 20 marks.

CHROMATOPHORES in plants were for long regarded as merely temporarily differentiated fragments of the cytoplasm, and, even within the present decade, were viewed as cell-organs the physiological behaviour of which is largely or mainly determined by the general protoplasm; but more recent investigations have increasingly led botanists to regard chromatophores, not only as morphological individuals—so to speak—within the cell, but also as physiological organisms in the energid. The climax of this view is the suggestion that chromatophores are in phylogeny nothing more than descendants of parasitic green organisms which entered into symbiosis with cells not possessing chlorophyll. Though this extreme hypothesis is not favoured by Dr. Senn, the evidence which he supplies causes him to conclude that chromatophores have larger powers of active contractility and more varied irritability than has hitherto been believed. He concludes that their change of shape and movements in the cell are exclusively or mainly the result of their own special activity, and that they are not passively distorted or transported by the cytoplasm (though he naturally admits their passive carriage by rotating protoplasm and the like).

The book begins with the consideration of the change of shape of the individual chloroplast, a phenomenon generally neglected by botanical teachers, though easily visible in such familiar laboratory types

as *Funaria* and *Vaucheria*. Dr. Senn describes the changes of shape in a number of types, and discusses the parts played in causing them by light, temperature, and chemical and other agencies. His general conclusion is that change of shape of the chromatophore is occasioned by "diffuse," not directive stimuli.

The main mass of the book deals, however, with changes in position of the chromatophores in the cell. Eight different patterns of distribution are recognised—epistrophe, apostrophe, systrophe (round the nucleus), peristrophe (uniformly round the cell-walls), antistrophe (on the wall facing the light), diastrophe (on the wall facing the light and on that opposed to it), parastrophe (in shaded parts of the cell), and escharostrophe (at the focus of the rays of light entering the cell). The conclusion is drawn that change of position of the chromatophores in the cell is the result of "tropic tactic [taxis] stimulus," in which the direction of the stimulus (for instance, light) does not as such determine the result, but only does so indirectly by involving a difference in intensity. According to Dr. Senn the distribution of the chromatophores in the cell is not the result of a simple stimulus emanating from the general protoplasm or released by differences in turgidity, but is the consequence of several types of irritability (phototaxis, chemotaxis, thermotaxis, osmotaxis) possessed by the chromatophores, which thus react in the same manner as free zoospores or Protozoa.

An appendix treats of the refractive index of the plant cell.

In a brief notice it is impossible to do justice to the wealth of detail in the book, which, except in the case of the special investigator, is one to be consulted rather than read through; indeed, the present reviewer confesses that he has not read the whole of the 376 pages of text.

Apart from containing the results of prolonged research and numerous observations, this critical book derives value from the thorough manner in which the author considers and does justice to the work of his predecessors, also from the repeated summaries of the conclusions arrived at concerning the various problems investigated, and from the rich bibliography and excellent index. The book, in fact, is one that should at least be in the library of every botanical institute.

MODERN ALGEBRA.

- (1) *A New Algebra.* By S. Barnard and J. M. Child. Parts i.-iv., with answers. Pp. x+534. Price 4s. Part iv., with answers. Pp. x+(301-466). Price 1s. 9d. (London: Macmillan and Co., Ltd., 1909.)
- (2) *College Algebra.* By Dr. S. C. Davisson. Pp. ix+191. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1909.) Price 7s. 6d.

FEW branches of elementary mathematics have escaped the hand of the reformer during the last ten years. That this is a healthy symptom is unquestionable, for at least it points to a revival of interest, which cannot but infuse fresh life into a subject that the monotony of time may render arid and perfunctory. What measure of favour is to be

accorded to each set of changes must necessarily depend on the view that is taken of the purpose of a mathematical training in our educational system. It is not easy to form a combination of what is useful with what is interesting; and still less is it a simple matter to determine how far it is judicious to discuss at an early stage the fundamental ideas which underlie each branch of mathematics. But at the present time we believe that there is a dangerous tendency to pass over all considerations of mathematical philosophy as too difficult or uninteresting. We therefore welcome the present volume, which is a real attempt to build up an elementary course of algebra on the fundamental concepts of number and the operations to which it is subject.

The book is divided into four parts; the first deals with positive numbers, the second with zero and negative numbers, the third with irrationals, and the last with the more advanced applications, such as simultaneous quadratics, proportion, progressions, and the variation of simple functions. Each new idea that occurs is explained at considerable length in the text with admirable clearness, and is usually illustrated by graphical examples. In practice, no doubt, this will be used as the substance of an oral treatment, for few pupils will be sufficiently mature to be able to read and assimilate it unaided. There are abundant examples, a useful number of test papers, and an index which should prove of great practical value. We hope that this book will be widely used, for its principles are sound, and it introduces the student to a number of ideas that are both stimulating and instructive.

(2) This volume is intended to be used for a revision course. Stress is therefore laid on such features of the subject as are apt to be dealt with rather cursorily, or even omitted during the first reading. At the same time, however, the plan of the book is not designed to meet the wants of the professional mathematician, but to suit those who need a reasonably complete knowledge of the elementary principles of algebra. The remainder theorem and the principle of undetermined coefficients are placed in an early chapter; the section on linear equations contains also the fundamental properties relating to the roots of equations of any degree; and the theory of simultaneous equations is expanded to include an elementary account of the use of determinants. By such means as these, the author has provided a course which is admirably adapted for a second reading. The treatment is fresh and vigorous, the explanations are clearly put, and great care has been taken to ensure that the student really understands the nature of the various operations which he is called upon to perform.

OUR BOOK SHELF.

Les Tremblements de Terre. By l'Abbé Moreux. Pp. vii+378. (Paris: Henri Jouve, 1909.) Price 4 francs.

On June 11, 1909, towns in south-eastern France, and particularly those in the district of Provence, were shattered by an earthquake. The places which suffered most were Salon, Lambesc, Saint-Cannat,

Rognes, and Le Puy-Sainte-Réparate. Roughly speaking, the damage done to structures was estimated at 16,000,000 francs, which means something more than half a million sterling. From a monetary point of view this is a large sum, and it no doubt represents the effects of an unusually large earthquake. Had a similar rock adjustment taken place beneath a large city this sum would have been greatly magnified. The damage at San Francisco has been estimated at 70,000,000*l.* sterling. Naturally, the disaster excited the imagination, and survivors have speculated on the cause of earthquakes. One outcome of the thoughts which were so rudely created is the book by the Abbé Moreux.

The author has read much about earthquakes. At the outset, although he tells us that his writings are not addressed to specialists, he has taken pains to popularise speculations about which specialists have but slight knowledge. He gives us a series of pictures of the ruins, tells us about the heartrending cries of the people, the arrival of the doctors, the erection of huts, and the generosity of the Pope. Next we read about possible premonitory signs. We are told that before the earthquake people suffered from vertigo, clocks struck wrongly, whilst pigeons flew about rather than going to rest. One interesting picture, which is not unlike the Cullinan diamond, is that of our pyramidal earth, the fourth corner of which was found by Sir Ernest Shackleton.

Reference is made to recent investigations relating to seismology, from which we learn that our world has a rigidity double that of steel. Volcanic and seismic effects are not directly connected, but earthquakes are in part the result of tectonic adjustments. They hold a relationship to the wobbling of the pole, fluctuations in barometric pressure, the change of seasons, lunar and solar attractions, and to internal convection currents. Earthquakes explain certain perturbations of magnetic needles and earth currents, whilst they are closely associated with solar radiation. The periodicity of earthquakes and their prediction are subjects which are not overlooked, whilst many pages are devoted to construction in earthquake countries, and to the mitigation of disasters. The relationship of pressure to temperature as we descend in the earth, and the fact that bodies may during crystallisation, or when they pass from the fluid to the solid state, suddenly expand, are phenomena which the Abbé discusses at considerable length. In fact, we are told that the shock accompanying such expansions may be the principal cause of many earthquakes.

It is an interesting little book, and will furnish many with subjects for speculation which have never crossed their minds before. J. MILNE.

The Methods of Textile Chemistry, being the Syllabus of a Lecture Course adapted for use in Textile Laboratories. By Dr. F. Dannerth. Pp. viii+164. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1908.) Price 8s. 6*d.* net.

If the author had employed the title "Some Methods of Textile Chemistry" in place of the one he has chosen he would have erred on the right side. But to attempt to deal with the whole subject of textile chemistry—one of the most difficult and involved branches of analytical chemistry—in 120 small octavo pages of large type can scarcely result in anything of real value, even if the work is done as well as it is possible to do it. But when, as in the present case, the information is badly arranged, containing much that is superfluous if not useless, while omitting many matters of fundamental importance, and is not without a liberal sprinkling of mistakes and inaccuracies, the